

**Consumer Perceptions of Landscape Characteristics,  
Disease and Pest Problems, and the  
Value of Powdery Mildew Resistant Dogwood**



by

**William E. Klingeman <sup>1</sup>**

**John R. Brooker <sup>2</sup>**

**David B. Eastwood <sup>2</sup>**

**John B. Riley <sup>2</sup>**

**Bridget K. Behe <sup>3</sup>**

**Patricia Knight <sup>4</sup>**

<sup>1</sup> **Department of Plant Sciences and Landscape Systems**

<sup>2</sup> **Department of Agricultural Economics**

<sup>3</sup> **Department of Horticulture, Michigan State, East Lansing**

<sup>4</sup> **Department of Horticulture, Mississippi State University**

**Agricultural Experiment Station**  
**The University of Tennessee**  
**Knoxville**

## Table of Contents

Introduction .....	1
Objectives .....	3
Source of Data .....	3
Results .....	4
Demographics .....	4
Landscape Characteristics .....	6
Dogwoods in the Landscape .....	6
Pest/Disease Recognition and Landscape Management Philosophy .....	8
Expenditures on Landscape and Home Garden .....	13
Added-Value of Powdery Mildew Resistance .....	18
Summary and Closing Remarks .....	19
References .....	20
Appendix .....	22

Additional copies of this report may be obtained from:

Department of Agricultural Economics  
The University of Tennessee  
2621 Morgan Circle  
Knoxville, TN 37996-4500  
865-974-7231  
<http://web.utk.edu/~agecon/>

**E11-1215-00-006-02**

# **Consumer Perceptions of Landscape Characteristics, Disease and Pest Problems, and the Value of Powdery Mildew Resistant Dogwood**

by

William E. Klingeman, John R. Brooker, David B. Eastwood,  
John B. Riley, Bridget K. Behe, and Patricia R. Knight<sup>1</sup>

## **Introduction**

Flowering dogwoods (*Cornus florida* L.), which are native to eastern North America, are small to medium-sized understory trees that provide important habitat and food resources for wildlife (Eyde 1988; Mitchell 1988). Since 1988, the emergence and severity of two destructive plant diseases have severely impacted native stands and landscape plantings of flowering dogwoods and consequently, nursery sales of this ornamental tree. As a nursery product, dogwoods are important to Tennessee because combined retail and wholesale sales from Tennessee nurseries accounted for 23.2 percent of the dogwood trees sold from nurseries in the United States (1998 Census of Horticultural Specialties). Tennessee nursery producers sell more dogwood trees than the next two leading states, North Carolina and Oregon, combined.

Dogwood anthracnose (*Discula destructiva* Red.) was first observed in southeastern New York and southwestern Connecticut in 1978 and 1979, respectively (Hibben and Daughtry 1988). Dogwood anthracnose was not discovered in eastern Tennessee and the southern Appalachian Mountains until 1988 (Windham 1989). Forest plot surveys of the Great Smoky Mountain National Park in North Carolina and Tennessee indicated that by 1992, an average of 22 percent of the dogwood trees was dead (Windham, et al. 1995). Estimates made in 1996 suggested that between 75 and 85 percent of the remaining dogwoods were infected with anthracnose and many were dead or dying (Windham, unpublished data). In the nursery, however, anthracnose can be controlled using fungicide sprays. Trees subsequently planted in sunny, airy sites are at less risk from dogwood anthracnose. Spread of anthracnose through commercial markets has also been controlled with thorough plant inspections. Research efforts have further revealed 'Appalachian Spring' to be an anthracnose-resistant flowering dogwood cultivar (Windham, et al. 1998).

Since 1994, flowering dogwoods have been under assault from powdery mildew, caused by *Microsphaera pulchra* (Klein, et al. 1998; Ranney et al. 1995). Dogwood powdery mildew has been known for many years (Burrill and Earle 1887). Its development as a large-scale production problem is manifested by reduced seedling vigor, virtually halting cultivar production budding of infected trees, limited growth and reproduction among more mature dogwoods (Windham 1996), and the death of some small trees (Windham, unpublished data). Research efforts by the University of Tennessee Institute of Agriculture's Dogwood Research and Breeding Team have resulted in the identification of powdery mildew-resistant flowering dogwood seedlings (Windham 1996; Windham and Witte 1998). Plant patent applications for the three most promising clones are pending as the Appalachian™ series of dogwoods (Witte et al. 1999).

---

<sup>1</sup>Klingeman is an assistant professor in the Department of Plant Sciences and Landscape Systems, The University of Tennessee, Knoxville. Brooker, Eastwood and Riley are professors in the Department of Agricultural Economics, The University of Tennessee, Knoxville. Behe is an associate professor in the Department of Horticulture, Michigan State University, East Lansing. Knight is an associate horticulturalist, Coastal Research and Extension Center, Mississippi State University, Poplarville.

Tennessee ornamental producers are adversely affected by the increased cost of dogwood production. In 1984, the estimated cost of pest and disease control incurred in producing one acre of budded flowering dogwoods was approximately \$290 over a 3-year period (Badenhop, et al. 1985). Recent estimates place this figure closer to \$1,075 per acre, and the increase is attributed largely to the emergence of powdery mildew (Trigiano, personal communication).

Despite gains in controlling the disease and the discovery of disease-resistant flowering dogwoods, demand for dogwoods has been adversely impacted due to the increased likelihood of tree loss and cost of disease control. Awareness of the problem has spread via articles from popular press and news sources that present only bleak predictions of the future landscape potential for these trees (Davis 1997; Englander 1997). The discovery, development, and successful marketing of disease-resistant flowering dogwoods should stimulate renewed interest and confidence among consumers and nursery producers in this valuable ornamental crop.

To date, there has been little research to estimate consumer valuations of patented disease-resistant plant materials. Nursery producers have little guidance by which they can establish the wholesale or retail values of pest or disease resistant plant materials such as the powdery mildew resistant dogwoods. Therefore, nursery producers and ornamental researchers will benefit from a greater awareness of consumer comprehension of integrated pest management concepts. Moreover, consumer willingness to incur economic and aesthetic costs in order to limit pesticide use in their landscapes can become an important factor in future development, marketing, and pricing of pest and disease resistant ornamental plant materials.

Annually, from 1979 to 1993, U.S. agricultural, industrial/commercial/governmental, and home and garden demographic sectors applied more than 906 million pounds of active ingredients to control arthropod pests and plant diseases (Aspelin 1994). In response to heavy pesticide reliance by these sectors, the U.S. Department of Agriculture, U.S. Environmental Protection Agency, and Food and Drug Administration launched a joint initiative in 1993 to develop and deliver Integrated Pest Management (IPM) methods to 75 percent of U.S. crop acreage by the year 2000.

IPM has gained widespread attention as a multi-faceted approach to regulating pest and disease occurrence below levels that cause economic and aesthetic crop losses and has the capability of reducing reliance on chemical pesticides. Far from excluding pesticide controls, IPM incorporates pesticide chemistry into an array of pest management options, which may be selected individually or in combination. In addition to pesticide controls, management strategies include cultural, mechanical, physical controls, and host-plant resistance for regulating arthropod, weed, and disease populations. These IPM practices are widely applicable to crop production and landscape management programs and can be readily adopted by diverse end-users including agricultural and horticultural crop producers; landscape, forest, and golf course managers; and private homeowners.

Cultural control strategies often comprise the "first line of defense" in successful pest population management. Cultural management tactics include proper plant and site selection, weed and volunteer elimination, crop rotation, effective nutrition and water management, and sanitation. Despite the relative ease of many of these options, only 36 and 33 percent of surveyed greenhouse and nursery operations, respectively, identified these tactics as strategies that they employed for pest management (Oetting and Allison 1994). However, these statistics may not accurately reflect consumer, grower, and landscape manager use of these strategies. Survey respondents frequently fail to recognize that the control practices

they actively employ are considered "cultural". In reality, the need to educate consumers, growers, and landscape managers about IPM procedures is frequently cited as an area of critical need (Latimer, et al. 1996; Raupp, et al. 1989; Wearing 1988). Further, ornamental growers and landscape managers cite a lack of sufficient educational and resource information about IPM as well as limitations in economic incentives for implementing IPM practices or developing pest resistant plant materials (Latimer, et al. 1996).

In an urban landscape, appropriate selection and placement of plant materials can lower the probability of pest and disease outbreaks. This, in turn, reduces the need for pesticide applications and increases homeowner or client satisfaction with the aesthetic quality of their landscape surroundings. Within ornamental production systems, a steady consumer demand for plant cultivars and species resistant to arthropod pests and diseases will likewise reduce the need for pesticide applications to nursery and greenhouse stock. However, challenges remain to find effective educational outlets and efficient paths for information transfer, such as the use of garden writers and landscape architects (Garber and Bondari 1992; 1998). Once effective outlets for information exchange are identified, they can be used to generate consumer and client awareness of disease and pest resistant plant materials and to stimulate a desire to include these plants in their landscapes.

### **Objectives**

The general purpose of this study was to identify factors affecting consumer demand for landscape nursery products and services, to determine level of consumer recognition and understanding of integrated pest management terminology and practices, and to assess consumer willingness to pay a price differential for a flowering dogwood tree resistant to powdery mildew. Specific objectives were to determine:

1. selected characteristics about homeowners and their landscapes,
2. the importance of ornamental characteristics used by homeowners in selection of trees, shrubs, perennials, or annuals for their landscapes,
3. added value retail consumers are willing to pay for patented dogwood trees resistant to powdery mildew, and
4. consumer perceptions of dogwood pest/disease problems and consumers' familiarity with terms and concepts related to integrated pest management.

### **Source of Data**

In the spring of 2000, a survey questionnaire and display were created for use at home and garden shows. The display presented pictures of identical dogwoods, except one was infected with powdery mildew. Pictures of healthy and diseased leaves were included. Brief statements about the disease in easy-to-read language and print were part of the display. As individuals passed by the display, they were asked to participate in this educational, data collection effort.

Given this setting, respondents were individuals who were interested in landscapes, and consequently, were more apt to be knowledgeable about diseases, IPM, important tree and shrub attributes, and landscapes in general. Furthermore, those who answered the questionnaire comprised a group that was more likely to purchase ornamental trees and shrubs. A copy of the questionnaire is in the Appendix.

## Results

Survey participants returned 147 completed questionnaires at the “Dogwood Arts Festival Home and Garden Show” in Knoxville, Tennessee. Respondents at the “Lawn and Garden Show” in Nashville, Tennessee returned 269 completed surveys and "Bloomfest", a home and garden show in Detroit, Michigan generated 132 completed questionnaires. In Jackson, Mississippi, 62 questionnaires were completed by visitors to the “Garden and Patio Show.”

Chi square statistics are used to draw inferences about the association between respondents’ answers across the four survey locations and the various demographic, behavioral, and attitudinal categories. Whenever the computed chi squares reported in the following tables exceed the respective critical values, the conclusions are that the differences in response patterns for the listed categories do in fact differ by urban location.

### Demographics

The ratio of female to male respondents was roughly 1 to 1 in Knoxville and 3 to 2 in Nashville (Table 1). Significantly more survey participants in Detroit and Jackson were likely to be female, where the females to male ratios were 4 to 1 and 7 to 3, respectively.

**Table 1. Gender of Survey Participants**

	Knoxville (n=127)	Nashville (n=256)	Detroit (n=118)	Jackson (n=61)	Chi-square
	----- percent -----				
Female	48	58	80	70	28.85*
Male	52	42	20	30	
Total	100	100	100	100	

\* Significant at .05 level.

The age distributions of respondents were comparable across venues except for the 65 and over group which had proportionately more Detroit respondents (Table 2). Roughly 75 percent of respondents were between 35 and 64 years old. Only 10 percent or fewer participants who completed questionnaires were younger than 35. Senior citizens aged 65 years or older, represented 10 percent of the Jackson respondents, 12 percent of the Tennessee participants, and 20 percent of the Detroit respondents.

**Table 2. Age of Survey Participants**

	Knoxville (n=130)	Nashville (n=261)	Detroit (n=127)	Jackson (n=52)	Chi-square
	----- percent -----				
34 and under	9	10	5	10	13.03
35-44	24	25	22	17	
45-54	30	31	28	38	
55-64	25	22	25	25	
65 and over	12	12	20	10	
Total	100	100	100	100	

Respondents were asked to identify their before tax income categories for the previous year (Table 3). In all four locations, 75 percent or more of the respondents were willing to provide this information. The majority of survey participants indicated a moderate household income. Thirty percent or fewer of those who completed the forms identified household incomes that were greater than \$100,000. At each location, incomes of less than 50 percent of the participants did not exceed \$75,000. Higher income respondents were expected due to the prevalence of homeowners visiting the home and garden shows.

**Table 3. Income of Survey Participants**

	Knoxville (n=110)	Nashville (n=228)	Detroit (n=108)	Jackson (n=44)	Chi-square
	----- percent -----				
Less than \$50,000	36	28	35	34	
\$50,000 - \$74,999	33	32	19	29	
\$75,000 - \$99,999	17	16	14	14	15.19
\$100,000 and over	14	24	32	23	
Total	100	100	100	100	

Based upon the distributions of the income categories, median incomes of the participants were estimated (Table 4). Respondents in Detroit had the highest median income of \$69,048, and Knoxville was at the low end with a calculated median income of \$60,417.

**Table 4. Median Income of Survey Participants**

	Knoxville (n=110)	Nashville (n=228)	Detroit (n=108)	Jackson (n=44)
Calculated Median Income	\$60,417	\$67,466	\$69,048	\$63,500

In all four cities, current home-ownership ranged from 92 percent among survey participants in Knoxville to 98 percent in Jackson (Table 5). While not shown in the table, a few renters completed a questionnaire in each location; however, most renters, excluding Detroit, indicated they intended to purchase a home. Detroit was unique because none of the respondents indicated an intention to purchase a home.

**Table 5. Home Ownership**

	Knoxville (n=144)	Nashville (n=264)	Detroit (n=131)	Jackson (n=61)	Chi-square
	----- percent -----				
Own home	92	95	94	98	
Rent/Plan to Own	8	5	6	2	3.64
Total	100	100	100	100	

## Landscape Characteristics

In Jackson, 56 percent of the respondents owned homes on 1 acre or larger lots (Table 6). By contrast, 60 percent of Detroit participants lived on lots smaller than one-half acre. In Knoxville, 50 percent of participants owned homes situated on lots smaller than three-fourths of an acre. This variation in distribution of respondents' lot size among cities was statistically significant.

**Table 6. Average Homeowner Lot Size**

	Knoxville (n=137)	Nashville (n=248)	Detroit (n=110)	Jackson (n=57)	Chi-square
	----- percent -----				
0.25 acres or less	10	12	38	9	
0.26 - 0.49 acres	28	18	22	18	
0.50 - 0.74 acres	12	7	7	3	66.47 *
0.75 - 0.99 acres	14	18	7	14	
1 acre and over	36	45	26	56	
Total	100	100	100	100	

\* Significant at .05 level.

A grass lawn was a common landscape feature for more than 80 percent of the survey participants (Table 7). Significantly fewer Detroit respondents had wooded lots, which is consistent with their smaller lot size. Small size is the likely reason these respondents were more apt to have perennials and sprinkler systems, and less likely to have mostly open yards. Detroit respondents' greater use of container plantings may reflect the colder climate homeowners' likelihood of taking some plantings inside during cold periods. Regardless of location, roughly one-half of the survey respondents had yards with landscaped borders. Annual beds were present in more than 50 percent of landscapes, and 58 percent or more of the respondents incorporated perennial plants into their ornamental features. Slightly fewer than half of those surveyed reported the inclusion of a vegetable or herb garden into their landscapes. Detroit landscapes were twice as likely to include a sprinkler system than either city in Tennessee.

With the exception of Detroit, the majority of respondents were discontent with the landscapes they managed (Table 8). The greatest degree of discontent was evident among Knoxville participants, for whom 68 percent saw room for improvement. Only 41 and 43 percent of Nashville and Jackson participants were content with their landscapes. In Detroit, a slight majority of survey participants were content with the appearance of their landscapes.

## Dogwoods in the Landscape

Among Tennessee participants, dogwood trees were an ornamental staple with 80 percent or more homes featuring a dogwood in the landscape (Table 9). By contrast, a 53 percent majority of Detroit respondents did not have a dogwood in their landscape. The significant differences in proportion having dogwoods is not surprising due to the Michigan climate being less suitable for the tree. Respondents with dogwood trees in their landscape maintained the majority of them under full or partial shade (Table 10). Jackson residents were the most likely to have a dogwood located in full

**Table 7. Characteristics of Homeowner Landscape <sup>a</sup>**

	Knoxville (n=147)	Nashville (n=169)	Detroit (n=132)	Jackson (n=62)	Chi-square
	----- percent -----				
Wooded Lot	46	41	27	55	16.50 *
Perennials	62	68	78	58	11.35 *
Mostly Open Yard	52	42	27	42	19.39 *
Vegetable/Herb Garden	38	51	47	42	7.18
Annual Beds	54	58	64	50	4.33
Grass Lawn	81	87	83	85	2.50
Container Plantings	31	43	51	44	12.10 *
Landscaped Borders	48	55	55	45	3.85
Sprinkler System	11	11	24	13	14.47 *

<sup>a</sup> Respondents could chose more than one characteristic.

\*Significant at .05 level.

**Table 8. Homeowners Contentment with Landscape Appearance**

	Knoxville (n=143)	Nashville (n=261)	Detroit (n=124)	Jackson (n=61)	Chi-square
	----- percent -----				
Yes	32	41	52	43	
No	68	59	48	57	11.34 *
Total	100	100	100	100	

\* Significant at .05 level.

**Table 9. Have a Dogwood in the Landscape**

	Knoxville (n=147)	Nashville (n=267)	Detroit (n=131)	Jackson (n=61)	Chi-square
	----- percent -----				
Yes	86	80	47	72	
No	14	20	53	28	67.62 *
Total	100	100	100	100	

\* Significant at .05 level.

**Table 10. Location of Dogwoods in the Respondent's Landscape**

	Knoxville (n=126)	Nashville (n=212)	Detroit (n=60)	Jackson (n=44)	Chi-square
	----- percent -----				
Sun	48	38	30	9	
Shade / Partial Shade	52	62	70	91	22.22 *
Total	100	100	100	100	

\* Significant at .05 level.

or partial shade, which differed significantly from the distribution in Knoxville where the response was close to being equal.

Nashville residents who have dogwoods in their landscape reported the presence of powdery mildew on 35 percent of their dogwoods (Table 11). For Jackson, 23 percent of the respondents identified powdery mildew as a concern. For Knoxville and Detroit respondents, 18 and 15 percent, respectively, reported powdery mildew as a problem. Drought injury was significantly lower with the Detroit respondents (11 percent) than the 26 to 34 percent obtained in the other three cities. Trunk cracks or splits were noted as a problem by a larger share of respondents in Nashville (33 percent) and a lower share in Detroit (21 percent). Responses regarding anthracnose leaf spots were significantly different among the four cities, ranging from a high of 20 percent in Knoxville to only 2 percent in Jackson. Among all cities, 9 percent or less identified borers as a concern, and 2 percent or fewer respondents indicated problems with dogwood twig gall midge. According to the respondents who managed a dogwood in their landscapes, nearly one-fourth to one-third were unable to comment on possible pest or disease problems.

**Table 11. Dogwoods in the Landscape Having Pest/Disease Problems <sup>a</sup>**

	Knoxville (n=127)	Nashville (n=214)	Detroit (n=61)	Jackson (n=44)	Chi-square
	----- percent -----				
Powdery Mildew	18	35	15	23	17.35 *
Drought Injury (Brown Leaf Tips)	26	34	11	34	12.99 *
Trunk Cracks or Splits	30	33	21	23	4.02
Anthracnose Leaf Spots	20	14	7	2	11.60 *
Borers	8	9	3	5	3.14
Dogwood Twig Gall Midge	1	2	2	2	0.77
Don't Know	30	24	30	34	2.55

<sup>a</sup> Only among respondents who reported having a dogwood in their landscape. Respondents could check all that applied.

\* Significant at .05 level.

### **Pest/Disease Recognition and Landscape Management Philosophy**

Self-diagnosis of pest and disease problems ranged from a low of 73 percent in Knoxville to a high of 84 percent in Nashville (Table 12). Friends were more frequently identified as pest or disease diagnosticians than were university Extension personnel who did not give assistance to more than 15 percent of the respondents in any city. Detroit and Jackson respondents were significantly more likely to consult a nursery or garden center to identify pest and disease problems than were their Tennessee counterparts. Where pest and disease problems required pesticide management, significantly more Tennessee and Jackson respondents applied chemical controls themselves than Detroit respondents (Table 13). Less than one-fourth used commercial application firms.

The distributions of responses reflecting the approximate levels of plant injury that were tolerable in order to limit pesticide use in the landscape were similar (Table 14). Fewer than 10 percent were willing to accept high levels of injury on landscape plants. Similarly, 10 percent or less favored strict pesticide use to maintain a pristine landscape. Respondents were concentrated in the medium and low acceptable levels of injury.

**Table 12. How Pest/Disease Problems Are Identified**

	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Chi-square
	----- percent <sup>a</sup> -----				
Self Diagnosed	73	84	77	77	6.57
Commercial Service	7	7	15	19	12.48 *
Extension	7	13	12	15	4.67
Friend	18	13	18	19	2.91
Nursery/Garden Center	6	9	17	14	9.68 *
Other <sup>b</sup>	4	7	5	2	nc

<sup>a</sup> Respondents checked all that applied, thus columns do not sum to 100 percent.

<sup>b</sup> "Other" responses included magazine articles, the Internet, and gardening television shows.

\* Significant at .05 level. nc=not computed.

**Table 13. How Pesticides Applied**

	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Chi-square
	----- percent -----				
Self	81	84	70	81	10.33 *
Commercial Service	12	7	24	5	26.23 *
Left Uncontrolled <sup>a</sup>	15	14	23	19	nc

<sup>a</sup> Respondents who provided no answer are assumed to have left the problem uncontrolled. Columns do not sum to 100 because respondents could have checked both self and commercial service.

\* Significant at .05 level. nc= not calculated.

**Table 14. Level of Plant Injury Acceptable in the Absence of Pesticide Use**

	Knoxville (n=129)	Nashville (n=259)	Detroit (n=122)	Jackson (n=51)	Chi-square
	----- percent -----				
High Injury	5	4	9	6	
Medium Injury	46	46	45	41	
Low Injury	40	44	37	43	6.59
No Injury Tolerated	9	6	9	10	
Total	100	100	100	100	

Responses about gardening and grower magazine readership were varied (Table 15). Significantly more Detroit participants indicated that they regularly read gardening magazines. By contrast, only one-third of Nashville participants indicated similar readership. Knoxville respondents were almost evenly split. The list of magazine titles most frequently identified by the respondents included: 1) *Better Homes and Gardens*, 2) *Organic Gardening*, 3) *Southern Living Magazine*, 4) *Garden Gate*, and 5) *Horticulture* (Table 16). The diversity of magazine selection suggests a broad range of reader interest.

**Table 15. Regular Readership of Garden/Grower Magazines**

	Knoxville (n=142)	Nashville (n=266)	Detroit (n=128)	Jackson (n=62)	Chi- square
	----- percent -----				
Read Garden Magazines	54	33	74	69	
Do Not Read Garden Magazines	46	67	26	31	13.83 *
Totals	100	100	100	100	

\* Significant at .05 level.

**Table 16. Magazines Attracting Respondent Readership**

	Knoxville (n=76)	Nashville (n=177)	Detroit (n=95)	Jackson (n=43)	Combined (n=391)
	----- number -----				
Better Homes and Gardens	16	10	20	2	48
Organic Gardening	6	26	14	2	48
Southern Living	7	24	0	8	39
Garden Gate	2	15	14	3	34
Horticulture	7	10	15	0	32
Fine Gardening	4	9	9	0	22
Birds and Blooms	2	7	6	2	17
Country Gardener	0	4	5	0	9
American Gardener	1	2	4	1	8
Country Living	2	3	2	0	7
National Gardener	0	2	4	0	6
Home Gardening	1	3	1	0	5
Martha Stewart's Living	0	3	1	0	4
Michigan Gardener	0	0	4	0	4
Rebecca's Garden	0	1	3	0	4
English Garden	1	0	2	0	3
Canadian Gardener	0	0	2	0	2
Other <sup>a</sup>	11	9	18	7	45

<sup>a</sup> Includes all other titles listed only once by a respondent in the combined four locations.

Respondents were asked to indicate their familiarity with eleven IPM terms by use of the following choices: never heard, sounds familiar, I know a little, and I can explain (Table 17). The proportion of respondents who reported “knowing a little” or “being able to explain” the meaning of a term were combined. Unless a response was marked on the questionnaire, the assumption was that the respondent did not know the meaning of the term. Of the eleven terms, there were only three where the differences among the cities were significant - pest scouting, pest tolerance, and organic farming. For these three terms, the lowest percentages of familiarity were reported for Knoxville. With respect to organic farming, respondents in Nashville and Detroit were significantly more familiar with the term than respondents in Knoxville and Jackson. Respondents were least familiar with the terms mycorrhizal fungi, pheromone

trapping, beneficial insects, and IPM. Overall, Nashville and Detroit seemed to have the more knowledgeable respondents since the percentage of familiarity was highest in Nashville for six of the 11 terms and highest in Detroit for the other five terms.

**Table 17.- Familiarity with Integrated-Pest-Management (IPM) terms <sup>a</sup>**

Terms in same order as listed on questionnaire	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Chi-square
----percent who reported “knowing a little” or “being able to explain” ----					
Pest tolerance	46	66	58	56	16.00 *
Biological control	51	58	55	45	3.97
Mycorrhizal fungi	12	13	15	15	0.84
Insecticide resistance	50	64	63	63	8.68
IMP	32	33	40	24	5.17
Beneficial insects	24	30	42	29	10.79
Pest scouting	66	84	80	73	18.47 *
Urban landscape	55	65	60	56	4.21
Land stewardship	42	49	42	48	2.46
Organic farming	68	80	81	71	10.63 *
Pheromone trapping	24	27	36	23	5.70

<sup>a</sup> The respondents in this table reported “knowing a little” or “being able to explain” the meaning of a term and were combined. Respondents indicating that they “never heard of a term” or that it “sounds familiar” were excluded.

Survey participants were asked to indicate where they purchase plants (Table 18). Retail chains and independent garden centers were identified by 50 percent or more of respondents in all four cities as their source of plants. Third in overall frequency were nurseries, as 40 to 55 percent of the respondents reported purchasing their landscape plants directly from the nursery grower. Less than 25 percent of Tennessee respondents identified a farm market or truck stand as a place they shopped, while a third of Detroit respondents patronized this market segment. Nearly half of Nashville and Detroit respondents purchased plants by mail order, which was a significantly higher proportion of purchases than by respondents in Nashville and Jackson. Grocery stores were identified as a source of plants by fewer than 10 percent of all respondents, regardless of surveyed city. Only 11 to 25 percent of respondents employed a landscaper or contractor to supply their landscape plants.

Participants were also asked to rate the quality of plants that they purchased for their landscapes (Table 19). While only five percent of Nashville residents were unsure of the quality of plant materials that they had purchased, a significantly larger 23 percent of respondents in Jackson were not sure. About 16 percent of Tennessee respondents and half as many Detroit and Jackson participants indicated that their purchased plants were "Poor" or "Mediocre" in quality. Similarly, 15 percent or fewer of all respondents rated their plants as being of excellent quality. The majority of respondents, from 63 percent in Jackson to 70 percent of Nashville participants, assessed the quality of the plants they purchased as "Good".

**Table 18. Type of Outlet for Landscape Plant Purchases**

	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Chi-square
	----- percent -----				
Independent Garden Center	55	60	70	61	6.50
Retail Chain	61	70	58	50	12.64 *
Nursery	47	55	49	40	5.22
Mail Order	38	48	46	21	16.53 *
Farm Market/Truck Stand	16	24	33	13	14.32 *
Landscaper/Contractor	20	25	24	11	6.26
Grocery	7	9	8	5	1.24

<sup>a</sup> Respondents could check all that applied.

\* Significant at .05 level.

**Table 19. Perception of the Quality of Landscape Plants Purchased**

	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Chi-square
	----- percent -----				
Not Sure	12	5	8	23	
Poor and Mediocre <sup>a</sup>	16	16	8	8	
Good	64	70	69	63	32.91 *
Excellent	8	9	15	6	
Total	100	100	100	100	

<sup>a</sup> Poor and mediocre were combined.

\* Significant at .05 level.

While the number of combined respondents who purchased plants from the seven different market outlets presented in the questionnaire ranged from 385 (retail chains) down to 48 (grocery stores), the relative distributions of these responses among the four quality options were remarkably similar (Table 20). For every outlet, at least 80 percent of the respondents reported that they thought the quality of plants was good or excellent.

**Table 20. Respondents Perception of Plant Quality by Type of Outlet**

	Retail chain (n=385)	Garden center (n=372)	Nursery (n=306)	Mail order (n=258)	Farm market (n=140)	Land- scaper (n=135)	Grocery store (n=48)
	----- percent -----						
Not sure	2	2	3	2	4	1	6
Poor/Mediocre	18	12	13	18	15	15	6
Good	74	78	73	69	71	72	86
Excellent	6	8	11	11	10	12	2
Total	100	100	100	100	100	100	100

The relationship between income and choice of outlet as a source for plant material was fairly similar across all outlets (Table 21). The only notable point is that a relatively higher percentage of respondents in the top income category and a relatively smaller percentage in the lowest income category obtained plant material from landscapers.

**Table 21. Respondents Source of Plant Material by Income**

Income range (n=490)	Retail chain (n=330)	Garden center (n=319)	Nursery (n=257)	Mail order (n=228)	Farm market (n=117)	Land- scaper (n=114)	Grocery store (n=38)
----- percent -----							
\$49,999 or less	30	29	33	28	31	23	32
\$50,000 - 74,999	31	29	29	31	25	30	32
\$75,000 - 99,999	16	16	15	19	20	15	16
\$100,000 or more	23	26	23	22	24	32	21
Total	100	100	100	100	100	100	100

### Expenditures on Landscape and Home Garden

In addition to direct plant purchases, home, lawn, and garden show attendees in each city were asked to estimate their annual expenditures on landscape-related items and services (Table 22). Expenses reported by all survey participants were relatively consistent. Average annual expenditures were calculated in two ways. First, respondents who left all parts of this question blank were assumed to have made no expenditures in 1999. Even with this inclusion of expenditures for 10 to 24 percent of the respondents in four locations, average expenditures ranged from \$418 in Jackson to \$916 in Nashville. Second, when only respondents who entered a value for at least one expenditure category were considered, average annual expenditures ranged from \$552 in Jackson to \$1,058 in Nashville.

Values regarding average expenditures per category were based on the respondents who spent money on the category in 1999. For each city, more respondents reported purchasing annuals and perennials than any other category. Percentages of respondents who purchased a tree in 1999 were equal (27 percent) for Knoxville, Nashville, and Detroit, and dropped to 21 percent for Jackson. Detroit respondents spent the most for trees with an average of \$474. Nashville respondents who purchased equipment averaged \$646 among the 36 percent of the respondents who answered this question, compared to a low of only \$201 per respondent among the 48 percent of respondents who answered in Detroit.

Also noteworthy is the much higher percentage of respondents in Detroit who used a spray service. Both Knoxville and Detroit respondents spent considerably more on the “other” category than those in Nashville or Jackson. This “other” category includes hardscape, decorative ornamentals, and water garden features.

Participants were asked to rank the top five factors they used when purchasing trees and shrubs for their landscapes (Table 23). Because of the large number of respondents who simply checked a factor on the questionnaire instead of ranking five items from 1 through 5, all responses with a number or a check mark were considered to be an indication that the factor was important.

**Table 22. Average Expenditures on Landscape and Home Garden in 1999**

	Knoxville	Nashville	Detroit	Jackson
Average expenditure: entire sample (number of respondents) <sup>a</sup>	\$699 (n=147)	\$916 (n=269)	\$869 (n=131)	\$418 (n=62)
Average expenditure among those listing expenses: (percent of respondents) <sup>b</sup>	\$886 (79)	\$1,058 (87)	\$973 (90)	\$552 (76)
Average expenditures by category:	(n=116)	(n=234)	(n=118)	(n=47)
Annuals and perennials (percent of respondents) <sup>c</sup>	\$155 (72)	\$185 (81)	\$174 (91)	\$139 (79)
Shrubs	\$231 (34)	\$388 (42)	\$523 (37)	\$221 (45)
Trees	\$388 (27)	\$340 (27)	\$474 (27)	\$225 (21)
Equipment	\$481 (44)	\$646 (36)	\$201 (48)	\$371 (21)
Mulch	\$127 (58)	\$177 (64)	\$118 (46)	\$160 (40)
Seeds	\$37 (47)	\$47 (45)	\$50 (39)	\$59 (36)
Spray service	\$249 (8)	\$290 (11)	\$189 (23)	\$188 (13)
Fertilizer	\$49 (63)	\$72 (57)	\$75 (60)	\$62 (62)
Pesticides	\$36 (41)	\$52 (37)	\$68 (25)	\$73 (42)
Mowing and maintenance	\$355 (29)	\$355 (30)	\$326 (26)	\$137 (17)
Other <sup>d</sup>	\$981 (12)	\$405 (15)	\$ 1,185 (11)	\$217 (6)

<sup>a</sup> Averages calculated among all survey participants within a city. Respondents with no values entered for this question were assumed to be zero for this calculation.

<sup>b</sup> Includes all respondents who entered a dollar value for at least one category.

<sup>c</sup> Number of respondents for each category divided by the total number of respondents who provided an answer to this question.

<sup>d</sup> "Other" items listed by respondents included hardscape components, soil and sod, decorative ornaments, and water garden features.

**Table 23. Reasons to Select Trees for Landscape Use**

Factor	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Combined (n=610)
	----- percent -----				
Size/Shape <sup>a</sup>	51	48	61	40	51
Ease of Maintenance	47	43	44	42	45
Attracts Birds/Animals	37	31	38	32	34
Flower Color	30	35	32	37	33
Flowering Season	35	31	32	35	32
Leaf Color	24	33	35	27	31
Sun/Shade Preference of Tree	24	25	29	19	25
To Create Shade	25	24	22	31	25
Availability	22	23	20	23	23
Disease Resistance	20	22	24	23	22
Longevity	20	19	26	26	21
Winter Appearance	15	19	28	19	20
Native	27	19	17	18	20
Butterflies/Beneficial Insects	18	15	19	16	17
Growth Rate	24	17	11	15	17
Water Needs	22	16	12	10	16
Length of Flowering Period	11	15	14	16	14
Familiarity	17	12	14	15	14
Soil Preferences	11	9	16	5	10
Fruit	6	13	12	8	10
Insect/Mite Resistance	5	10	10	15	9
University Tested	0	1	2	2	1
Other Factors (< 2% each)	3	7	5	0	5

<sup>a</sup> The only factor with a significant chi-square at the .05 level (8.67).

Key considerations when purchasing trees were mostly consistent among cities. “Size and Shape” was the only factor with a significant chi-square value, and it was also the leading factor in every city, ranging from 40 percent in Jackson to 61 percent in Detroit. The next five, with only slight variation among the locations, included "Ease of Maintenance", "Attractiveness to Birds and Animals", and "Flower Color", “Flowering Season,” and “Leaf Color”. Respondents of each city were uniform in their opinions that "University Tested" was the least important consideration. In all cities, "Insect/Mite Resistance" and “Fruit” failed to rank among the top 15 reasons why consumers selected trees for their landscapes.

In addition to considerations that consumers deem important when purchasing trees, respondents were asked to identify the key criteria used for selecting shrubs, perennials, and annuals for landscape use (Table 24). "Flowering Season", "Sun/Shade Requirements", "Length of Flowering Period", "Size and Shape", "Ease of Maintenance", and "Attractiveness to Birds and Animals" were the leading factors in all four cities. In addition, "Butterfly and Beneficial Insect Attraction" was seventh among Nashville and Detroit respondents. As with trees, "Insect/Mite

**Table 24. Reasons to Select Shrubs/Perennials/Annuals for Landscape Use**

Factor	Knoxville (n=147)	Nashville (n=269)	Detroit (n=132)	Jackson (n=62)	Combined (n=610)
	----- percent -----				
Flowering Season	42	50	57	43	49
Sun/Shade Requirements	37	46	48	35	43
Length of Flowering Period	38	43	48	40	43
Size/Shape <sup>a</sup>	36	41	45	24	39
Ease of Maintenance	44	38	35	39	39
Attracts Birds/Animals	37	28	35	26	31
Butterflies/Beneficial Insects	24	28	29	24	27
To Try a New Plant <sup>b</sup>	16	27	31	18	24
Longevity	23	24	18	32	23
Plant Quality	23	21	25	26	23
Water Needs	25	22	23	16	22
Leaf Color	22	26	20	10	22
Disease Resistance	19	17	20	23	19
Winter Appearance	16	18	16	11	17
Availability	14	12	17	13	14
Native	18	13	16	8	14
Familiarity	15	13	11	15	13
Insect/Mite Resistance	10	10	12	11	10
Soil Preferences	13	9	15	8	11
University Tested	1	1	4	3	2
Other Factors (< 2 % each)	3	6	2	0	4

<sup>a</sup> Significant chi-square at the .05 level (8.96).

<sup>b</sup> Significant chi-square at the .05 level (10.94).

Resistance", "Soil Preferences", and "University Tested" were never ranked among the top 15 considerations. "Size and Shape" demonstrated significant variation among the cities. Jackson respondents ranked it eighth instead of fourth as in the other three cities. One other factor, "To Try a New Plant" had a significant Chi-square value indicating statistical variation among the responses. The percentage of respondents in Detroit noting this factor as important was almost twice as high as the respondents in Knoxville, 31 to 16 percent, respectively.

Though respondents identified several organisms as beneficial or environmentally helpful, three insects emerged that were readily recognized in all cities: ladybug(s), the praying mantis, and [honey]bees (Table 25). When asked to name a beneficial or environmentally helpful bird, purple martins, bluebirds, hummingbirds, and robins were the most frequently identified when summed among cities (Table 26). Participants also listed bats in this category. Respondents among the surveyed cities were less uniform in the beneficial or environmentally helpful plants that they named (Table 27). Still, marigolds and butterfly bush were the most frequently identified beneficial plants.

**Table 25. Name a Beneficial (Environmentally Helpful) Insect**

	Knoxville (n=94)	Nashville (n=200)	Detroit (n=97)	Jackson (n=37)	Combined (n=428)
	----- number -----				
Ladybug(s)	54	149	74	28	305
Praying Mantis	20	19	11	2	52
Bee(s)	12	4	7	5	28
Spider	2	4	1	0	7
Butterfly	1	3	1	1	6
Beetles	1	2	1	0	4
Earthworm <sup>a</sup>	1	3	0	0	4
Lacewing	1	1	2	0	4
Dragonfly	1	0	0	1	2
Nematode <sup>a</sup>	0	1	1	0	2
Syrphid Fly	1	0	0	0	1
Other	0	3	0	0	3

<sup>a</sup> Respondents identified an organism that is not an insect.

**Table 26. Name a Beneficial (Environmentally Helpful) Bird**

	Knoxville (n=71)	Nashville (n=173)	Detroit (n=72)	Jackson (n=30)	Combined (n=346)
	----- number -----				
Purple Martin	8	47	13	9	77
Bluebird	15	34	4	5	58
Hummingbird	9	30	11	4	54
Robin(s)	7	22	11	2	42
Woodpecker	4	4	7	1	16
Swallow	5	4	4	1	14
All	5	5	2	0	12
Mockingbird	3	4	0	2	9
Bat <sup>a</sup>	2	2	3	0	7
Cardinal	1	4	1	0	6
Vulture(s)	1	3	1	1	6
Owl(s)	0	3	2	0	5
Blue Jay	1	1	1	1	4
Finch	1	1	2	0	4
Wren	1	1	1	1	4
Chickadee	1	1	1	0	3
Guinea Hen	1	0	0	1	2
Nuthatch	1	0	1	0	2
Starling	0	0	2	0	2
Cedar Waxwing	1	0	0	0	1
Other	2	4	2	2	8

<sup>a</sup> Respondents identified an organism that is not a bird.

**Table 27. Name a Beneficial (Environmentally Helpful) Plant**

	Knoxville (n=61)	Nashville (n=137)	Detroit (n=74)	Jackson (n=25)	Combined (n=297)
	----- number -----				
Marigold(s)	18	30	12	5	65
Butterfly Bush	5	9	9	2	25
All	6	10	4	1	21
Clover(s)	1	8	1	1	11
Echinacea/Purple Coneflower	2	5	1	0	8
Geranium	0	4	4	0	8
Oak	1	3	2	1	7
Aloe	1	4	1	0	6
Milkweed	0	2	4	0	6
Sunflower	1	3	2	0	6
Bee Balm	1	3	1	0	5
Dogwood	3	1	0	0	4
Grass / Fescue	2	2	0	0	4
Garlic	1	2	1	0	4
Cattails	1	1	0	1	3
Foxglove	1	0	2	0	3
Citronella (Mosquito Plant)	0	2	0	0	2
Honeysuckle	1	1	0	0	2
Other	14	33	18	12	62

**Added-Value of Powdery Mildew Resistance**

Survey respondents were asked to review a photographic display that featured a large flowering dogwood in full flower, powdery mildew-infected foliage, and clean foliage. Captions explained what the viewers were observing and described the symptoms and influence of powdery mildew on tree performance. After viewing the display, participants were asked "How much more they would be willing to pay" for a 5-foot tall flowering dogwood with a 1-inch trunk caliper sold in a 5-gallon container, which was resistant to powdery mildew. Added-value of a powdery mildew resistant dogwood tree ranged from \$11.87 in Jackson to \$16.38 in Detroit (Table 28). Note that the "perceived" added value of the mildew resistance response parallels the average expenditure for trees values presented in Table 22.

**Table 28. Added Value of a Powdery Mildew Resistant Dogwood to Respondents <sup>a</sup>**

Additional dollars willing to pay	Knoxville (n=135)	Nashville (n=252)	Detroit (n=124)	Jackson (n=54)
	----- dollars -----			
Average added value	14.58	13.91	16.38	11.87
Standard deviation	7.70	7.60	8.11	7.74

<sup>a</sup> Additional amount respondents stated they would be willing to pay for 5 foot tall flowering dogwood that is resistant to powdery mildew with a 1-inch trunk caliper in a 5-gallon container.

## Summary and Closing Remarks

The initial focus of this study was to obtain insight regarding the additional amount that customers would be willing to pay for a patented dogwood cultivar resistant to powdery mildew. After determining that it would be suitable to collect data from visitors to "home and/or garden" shows in metropolitan locations, it seemed reasonable to use the opportunity to also collect information from respondents regarding their preferences and perceptions about several related topics. A total of 562 questionnaires were completed by visitors to such shows in Knoxville and Nashville, Tennessee; Detroit, Michigan; and Jackson, Mississippi.

Among the four cities, a significantly higher percentage of respondents in Nashville (29%) reported having powdery mildew as a problem with their dogwood trees. As anticipated, the percentage of dogwood diseases identified by respondents was lowest in Detroit because less than half of the respondents indicated that they have a dogwood in their landscape, while in the other three cities 72 percent or more reported having a dogwood tree.

Most respondents in all four cities reported that they diagnosed pest/disease problems themselves. The highest percentage of respondents using a commercial service to diagnose problems was reported in Jackson (19%); however, only 5 percent reported using a commercial service to apply pesticides. Nearly one-fourth of Detroit's respondents employed a commercial service to apply pesticides. Most respondents in all four locations were willing to accept low or medium levels of plant injury to avoid application of pesticides.

Percent of respondents who indicated "they know a little about" or "could explain" integrated-pest-management (IPM) ranged from 24 percent of the respondents in Jackson to 40 percent in Detroit. For respondents in all four locations, the highest percentages associated with knowledge of IPM terms occurred with organic farming and pest scouting. The lowest levels of familiarity were with the terms mycorrhizal fungi and pheromone trapping, and responses among the four locations were not significantly different.

Retail chains and independent garden centers were identified in all four cities as the major sources of plants by 50 percent or more of respondents. Third in overall frequency were nurseries, as 40 to 55 percent of the respondents reported purchasing their landscape plants directly from the nursery grower. Only 11 to 25 percent of respondents employed a landscaper or contractor to supply their landscape plants. The majority of respondents, ranging from 63 percent in Jackson to 70 percent of Nashville participants, assessed quality of the plants they purchased as "Good".

Annual expenditures on landscape-related items and services ranged from \$522 in Jackson to \$1,058 in Nashville. For each city, more respondents reported purchasing annuals and perennials than inputs in any other category. Detroit respondents spent the most for trees with an average annual expenditure value of \$474. Key considerations when purchasing trees were "Size and Shape", "Ease of Maintenance", "Attractiveness to Birds and Animals", "Flower Color", "Flowering Season", and "Leaf Color". When asked to name a beneficial or environmentally helpful bird, purple martins, bluebirds, hummingbirds, and robins were the most frequently identified.

How much more a shopper would be willing to pay for a powdery mildew resistant dogwood, was rather consistent across all four locations. Average values ranged from a low of \$11.87 in Jackson, MS, to a high average of \$16.38 in Detroit, MI. The uniformity would seem to support the proposition that customers are willing to pay a substantially higher price to purchase a product that will maintain a healthier appearance without the use of chemical sprays.

## References

- Aspelin, A. L. 1994. *Pesticide Industry Sales and Usage: 1992 and 1993 Market Estimates*. Office of Pesticide Programs. USEPA, Washington, DC.
- Badenhop, M.B., W. T. Witte, and T. E. Glasgow. 1985. *Production Systems and Costs for Producing Balled and Burlapped Trees of Dogwood Cultivars, Tennessee, 1984*, TN Agr. Exp. Sta. Bul. 637.
- Burrill, T. J., and F. S. Earle. 1887. *Parasitic Fungi of Illinois. Part II*. Bulletin of the Illinois State Laboratory of Natural History. J. W. Franks & Sons, Peoria, IL. 429 p.
- Davis, M. 1997. "Trees Still Dying - Half of Smokies' Dogwoods Gone." *Knoxville News Sentinel*, Feb. 23, p. 25.
- Englander, L. 1990. "Dogwood Blight." *Amer. Nurseryman* 172(11): 89.
- Eyde, R. H. 1988. "Comprehending *Cornus*: Puzzles and Progress in the Systematics of the Dogwoods." *Bot. Rev.* 54: 233-251.
- Garber, M. P. and K. Bondari. 1992. "Landscape Architects as Related to the Landscape/ Nursery Industry: I. Impact on Demand for Plant Material." *J. Environ. Hort.* 10:69-72.
- Garber, M. P. and K. Bondari. 1998. "Characteristics of Garden Writers and Their Information Sources." *J. Environ. Hort.* 16:207-211.
- Hibben, C. R., and M. L. Daughtrey. 1988. "Dogwood Anthracnose in Northeastern United States." *Pl. Dis.* 72: 199-203.
- Klein, L. A., M. T. Windham, and R. N. Trigiano. 1998. "Natural Occurrence of *Microsphaera pulchra* and *Phyllactinia guttata* on Two *Cornus* Species." *Plant Dis.* 82: 383-385.
- Latimer, J. G., R. D. Oetting, P. A. Thomas, D.L. Olson, J. R. Allison, S. K. Braman, J. M Ruter, R. B. Beverly, W. Florkowski, C. D. Robacker, J. T. Walker, M. P. Garber, O. M. Lindstrom, and W. G. Hudson. 1996. "Reducing the Pollution Potential of Pesticides and Fertilizers in the Environmental Horticulture Industry: I. Greenhouse, Nursery, and Sod Production." *HortTechnology* 6:115-124.
- Mitchell, W. A., P. A. Gibbs, and C. O. Martin. 1988. "Flowering Dogwood (*Cornus florida*): Section 7.5.9," *U.S. Army Corps of Engineers Wildlife Resources Management Manual*. Technical Report EL-88-9. U.S. Army Engineer Waterways Exp. Station, Vicksburg, MS.

- Oetting, R. D. and J. R. Allison. 1994. *The Biologic and Economic Assessment of Chlorpyrifos and Diazinon in Ornamentals and Sod Production*. USDA, Coop. Ext. Sys., Natl. Agric. Pesticide Impact Assessment Prog., Tech. Bull. 1837.
- Ranney, T. G., L. F. Grand, and J. L. Knighten. 1995. "Susceptibility of Cultivars and Hybrids of Kousa to Dogwood Anthracnose and Powdery Mildew." *J. Arboric.* 21: 11-16.
- Raupp, M. J., M. F. Smith, and J. A. Davidson. 1989. "Educational, Environmental, and Economic Impacts of Integrated Management Programs for Landscape Pests," p. 77-83. In: A. R. Leslie and R. L. Metcalf (eds.). *Integrated Pest Management for Turfgrass and Ornamentals*. USEPA, Washington, DC.
- U.S. Department of Agriculture, *1998 Census of Horticultural Specialties*, Washington, DC.
- Wearing, C. H. 1988. "Evaluating the IPM Implementations Process." *Annu. Rev. Entomol.* 33:17-38.
- Windham, M. T. 1989. "Epidemiology of Dogwood Anthracnose in Cherokee National Forest of Southeastern Tennessee". *Phytopathology* 79: 1149.
- Windham, M. T. 1996. "Resistance to Powdery Mildew in Flowering Dogwood." *Proc. SNA Res. Conf.* 41: 197-199.
- Windham, M. T., M. Montgomery-Dee, and J. M. Parham. 1995. "Factors Associated with Dogwood Anthracnose Incidence and Severity." *Tennessee AgriScience* 175: 17-20.
- Windham, M. T., E. T. Graham, W. T. Witte, J. L. Knighten, and R. N. Trigiano. 1998. "*Cornus florida* 'Appalachian Spring': A White Flowering Dogwood Resistant to Dogwood Anthracnose." *HortScience* 33: 1265-1267.
- Windham, M. T., and W. T. Witte. 1998. "Naturally Occurring Resistance to Powdery Mildew in Seedlings of *Cornus florida*." *J. Environ. Hort.* 16: 173-175.
- Witte, W. T., M. T. Windham, R. N. Trigiano, J. A. Skinner, W. E. Klingeman, J. F. Grant, E. T. Graham, P. C. Flanagan, and R. M. Augé. 1999. The Dogwood Improvement Program at the University of Tennessee. *Comb. Intl. Pl. Prop. Soc.* 49:71-74.

Appendix

**University of Tennessee Landscape Plant Survey**  
**All responses are voluntary and will remain anonymous**

*After viewing the poster on display and reading the information, assume your favorite retailer is selling dogwood trees (*Cornus florida*) that are 5 feet tall, have a 1-inch trunk diameter, are sold in a 5-gallon container, which are the typical size produced for consumers at garden centers and mass merchandisers.*

1. How much **more** would you be willing to pay for an identically sized flowering dogwood that is resistant to powdery mildew?

\$0 | | | | \$5 | | | | \$10 | | | | \$15 | | | | \$20 | | | | \$25 | | | | \$30

2. Do you presently: [ ] own a home, [ ] rent a home or apartment, [ ] plan to buy a home within 2 years?

3. Do you currently have a dogwood in your landscape? [ ] Yes, [ ] No

If yes, are the majority of your dogwoods in [ ] SUN; [ ] PART SHADE; [ ] SHADE

Do any of your dogwoods have (*check all that apply*):

- |                          |                                       |
|--------------------------|---------------------------------------|
| ___ powdery mildew       | ___ anthracnose (leaf spots)          |
| ___ dogwood borer injury | ___ dogwood twig gall midge           |
| ___ trunk cracks/splits  | ___ drought injury (brown leaf edges) |
| ___ don't know           |                                       |

4. Approximately how much did you spend last year (1999) in your home garden and landscape on:  
\$ \_\_\_\_\_ annuals & perennials; \$ \_\_\_\_\_ shrubs; \$ \_\_\_\_\_ trees; \$ \_\_\_\_\_ seeds;  
\$ \_\_\_\_\_ mulch; \$ \_\_\_\_\_ spray service; \$ \_\_\_\_\_ fertilizer;  
\$ \_\_\_\_\_ equipment; \$ \_\_\_\_\_ mowing / maintenance; \$ \_\_\_\_\_ pesticides;  
\$ \_\_\_\_\_ other \_\_\_\_\_

5. Describe your yard (*check all that apply*). Estimate its size in \_\_\_\_\_ Acres or \_\_\_\_\_ Sq. Ft.

[ ] wooded lot, [ ] mostly open yard, [ ] perennial beds, [ ] vegetable or herb garden  
[ ] landscaped borders, [ ] annual beds, [ ] grass lawn, [ ] container plantings.

6. Is your lawn and landscape maintained:  by **yourself or a family member**,  
 by **hired help**;  **left to grow on its own**.

7. **Are you content** with the appearance of your landscape?  **Yes**,  **No**

8. Do you regularly read a gardening/grower magazine?  **Yes**,  **No**

If yes, **which ones?** \_\_\_\_\_

9. Rank the **TOP 5 reasons** you pick landscape **TREES** (Rank Only 5; 1=most important).

- |  |   |
|--|---|
| <input type="checkbox"/> length of flowering period              | <input type="checkbox"/> winter appearance        |
| <input type="checkbox"/> availability                            | <input type="checkbox"/> flower color             |
| <input type="checkbox"/> water needs                             | <input type="checkbox"/> disease resistance       |
| <input type="checkbox"/> longevity                               | <input type="checkbox"/> size / shape             |
| <input type="checkbox"/> sun / shade preferences of tree         | <input type="checkbox"/> soil preferences         |
| <input type="checkbox"/> resistance to insects / mites           | <input type="checkbox"/> attracts birds / animals |
| <input type="checkbox"/> familiarity                             | <input type="checkbox"/> leaf color               |
| <input type="checkbox"/> easy maintenance                        | <input type="checkbox"/> flowering season         |
| <input type="checkbox"/> fruit                                   | <input type="checkbox"/> university tested        |
| <input type="checkbox"/> growth rate                             | <input type="checkbox"/> to create shade          |
| <input type="checkbox"/> attracts butterflies/beneficial insects | <input type="checkbox"/> other: _____             |
| <input type="checkbox"/> native                                  |   |

10. To reduce pesticide use, what level of injury to plants in your landscape would you accept?  
 **high**,  **moderate**,  **low**,  **none**

11. Are you familiar with these terms or concepts?

<b>Term or Concept</b>	<b>Never Heard It</b>	<b>Sounds Familiar</b>	<b>I Know a Little</b>	<b>I can explain</b>
Pest Tolerance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Biological Control	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mycorrhizal Fungi	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Insecticide Resistance	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Integrated Pest Management (IPM)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pest Scouting / Monitoring	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Beneficial Insects	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Urban Landscape	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Land Stewardship	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Organic Gardening	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pheromone Trapping	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

12. If you were choosing plants for your landscape, what would your **TOP 5 considerations** be?  
 (Rank Only 5; 1 = most important)

- |  |   |
|--|---|
| <input type="checkbox"/> insect/mite resistance                    | <input type="checkbox"/> familiarity                |
| <input type="checkbox"/> water requirements                        | <input type="checkbox"/> size / shape               |
| <input type="checkbox"/> to try a new plant                        | <input type="checkbox"/> leaf color                 |
| <input type="checkbox"/> sun / shade requirements                  | <input type="checkbox"/> availability               |
| <input type="checkbox"/> soil preferences                          | <input type="checkbox"/> native                     |
| <input type="checkbox"/> season of bloom                           | <input type="checkbox"/> length of flowering period |
| <input type="checkbox"/> winter appearance                         | <input type="checkbox"/> disease resistance         |
| <input type="checkbox"/> plant quality                             | <input type="checkbox"/> easy maintenance           |
| <input type="checkbox"/> longevity                                 | <input type="checkbox"/> attracts birds / animals   |
| <input type="checkbox"/> attracts butterflies / beneficial insects | <input type="checkbox"/> other: _____               |
| <input type="checkbox"/> University tested                         |   |

13. **Where do you shop** for landscape plants? (*Check all that apply*)

- |  |  |
|--|--|
| <input type="checkbox"/> retail chain                          | <input type="checkbox"/> farm market / truck stand |
| <input type="checkbox"/> landscaper / contractor               | <input type="checkbox"/> grocery                   |
| <input type="checkbox"/> independent / specialty garden center | <input type="checkbox"/> direct from nursery       |
| <input type="checkbox"/> mail order catalog                    | <input type="checkbox"/> other _____               |

14. In your opinion, is the quality of landscape plants you purchase:

- excellent**,  **good**,  **mediocre**,  **poor**,  **not sure**

15. Are you satisfied with the performance of these plants in the landscape?

- always**,  **often**,  **sometimes**,  **never**,  **not sure**

16. Name a Beneficial (or Environmentally Helpful . . .):

**insect** \_\_\_\_\_ **bird** \_\_\_\_\_ **plant / flower** \_\_\_\_\_

17. Are you  **Male**,  **Female**?

18. What is your approximate age?  15-24;  25-34;  35-44;  45-54;  55-64;  65+

19. Estimate your Gross Household Income before taxes this past year:

- |  |  |  |
|--|--|--|
| <input type="checkbox"/> less than \$25,000  | <input type="checkbox"/> \$25,000 - \$49,999   | <input type="checkbox"/> \$50,000 - \$74,999 |
| <input type="checkbox"/> \$75,000 - \$99,999 | <input type="checkbox"/> \$100,000 - \$124,999 | <input type="checkbox"/> \$125,000 or more   |